

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION  
DAM SAFETY INSPECTION

NAME OF DAM Ruby Dam  
DATE INSPECTED October 6, 2008

INVENTORY NO. MT 4  
HAZARD CATEGORY HIGH  
TYPE OF DAM Earth  
YEAR BUILT 1938

OWNER DNRC  
OPERATOR Ruby River Water Users Assoc.  
STREAM Ruby River  
DRAINAGE AREA 595 square miles

Reservoir Storage Status

	Water Surface Elevation (feet)	Storage (acre-feet)
At time of inspection	<u>5,366.96</u>	<u>16,841</u>
At spillway crest	<u>5,392.0</u>	<u>36,633</u>
At min. dam crest elevation	<u>5,409.2</u>	<u>56,355</u>
At spillway flashboard crest	<u>5,392.9</u>	<u>37,611</u>

Note: Storage volumes reflect the new storage volumes following the mapping completed in 1994.

ITEM	YES	NO	REMARKS
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**1. EMBANKMENT**

A. Crest -- Height= 111 feet    Length= 846 feet    Width= 25 feet

(1) Any visual settlements?		X	
(2) Any misalignments?		X	
(3) Any cracking?		X	
(4) Any traffic damage?		X	
(5) Other?		X	

ITEM	YES	NO	REMARKS
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**1. EMBANKMENT** (continued)

B. Upstream Face -- Slope= 1V on 2H and 1V on 3H

(1) Any erosion?	X		See comments.
(2) Any longitudinal cracks?		X	
(3) Any transverse cracks?		X	
(4) Is riprap protection adequate?	X		
(5) Any stone deterioration?		X	
(6) Any visual settlement, slumps, sloughing, depressions or bulges?		X	
(7) Adequate grass cover?	X		
(8) Debris on the dam face?	X		See comments.
(9) Other?	X		See comments.

C. Downstream Face--Slope= 1V on 2H

(1) Any erosion?		X	
(2) Any longitudinal cracks?		X	
(3) Any transverse cracks?		X	
(4) Any visual settlement, slumps, sloughing, slumps, depressions or bulges?		X	
(5) Is the toe drain dry?			See comments.
(6) Are the relief wells flowing?			Not applicable.
(7) Any boils at the toe?		X	
(8) Any seepage areas?		X	
(9) Any traffic or animal damage?		X	
(10) Any burrowing animals?		X	
(11) Adequate grass cover?	X		
(12) Other?			

D. Amount and Type of Vegetation on the Dam

See comments.
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ITEM	YES	NO	REMARKS
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## 2. ABUTMENT CONTACTS

A) Any erosion?		X	
B) Any visual differential movement?		X	
C) Any cracks?		X	
D) Any seepage present?		X	
E) Other?		X	

## 3. OUTLET WORKS

A. Intake Structure -- Size= Not visible, underwater

(1) Any settlement?			
(2) Any tilting?			
(3) Do concrete surfaces show:			
a. Spalling?			
b. Cracking?			
c. Erosion?			
d. Exposed reinforcement?			
(4) Do joints show:			
a. Displacement or offset?			
b. Loss of joint material?			
c. Leakage?			
(5) Metal appurtenances:			
a. Any corrosion present?			
b. Any breakage present?			
(6) Trash rack?			
a. Condition?			
b. Anchor system secure?			
(7) Other?			

ITEM	YES	NO	REMARKS
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### 3. OUTLET WORKS (continued)

B. Conduit -- Type = Reinforced concrete horseshoe Size = 90-inch wide and high

(1) Do concrete surfaces show:			
a. Spalling?		X	
b. Cracking?	X		See comments, Section 3.B.(2).c.
c. Erosion?		X	
d. Exposed reinforcement?		X	
(2) Do joints show:			
a. Displacement or offset?		X	
b. Loss of joint material?		X	
c. Leakage?	X		See comments.
(3) Is the conduit metal?		X	
a. Any corrosion present?		X	
b. Protective coatings adequate?			Not applicable.
(4) Is the conduit misaligned?		X	
(5) Any calcium deposits?		X	
(6) Other?	X		See comments.

### C. Gates and Tower

(1) Gates:			
a. Size: Operating: 72-inch diameter Emergency: 72-inch diameter			
b. Type: Operating: Butterfly Emergency: Slide			
(2) Controls operational?	X		
(3) Controls lubricated?	X		
(4) Operational problems?	X		See comments.
(5) Leakage around gates?		X	See comments.
(6) Condition of gate seals? Good			
(7) Any cavitation damage? If so, describe?	X		See comments
(8) Describe air vent-size and condition. 10-inch diameter – good			

ITEM	YES	NO	REMARKS
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### 3. OUTLET WORKS (continued)

#### C. Gates and Tower (continued)

(9) Is there a jet pump?	X		
a. Is it operational?	X		
b. Leakage?	X		See comments.
(10) Is the tower dry? <u>X</u> wet? _____ See comments			
(11) Any seepage in the tower?		X	
(12) Condition of the tower? Good			
(13) Any safety problems?		X	
(14) Ladder in good condition?	X		
(15) Condition of the gatehouse? Good			
(16) Emergency plan completed for the dam?	X		
a. Posted in the gatehouse?	X		
(17) Other?	X		See comments.

#### D. Stilling Basin

(1) Do concrete surfaces show:			
a. Spalling?	X		See comments, Section 3.D.(1).6.
b. Cracking?	X		See comments.
c. Erosion?		X	
d. Exposed reinforcement?		X	
(2) Do joints show:			
a. Displacement or offset?		X	
b. Loss of joint material?		X	
c. Leakage?		X	
(3) Do energy dissipaters show:			
a. Signs of deterioration?		X	
b. Are they covered with debris?		X	
(4) Other?			

ITEM	YES	NO	REMARKS
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### 3. OUTLET WORKS (continued)

#### E. Downstream Channel

(1) Is the channel:			
a. Eroding or backcutting?		X	
b. Sloughing?		X	
c. Obstructed?		X	
(2) Is released water:			
a. Undercutting the outlet?		X	
b. Eroding the embankment?		X	
(3) Other?	X		See comments.

### 4. SPILLWAY

#### A. Description

(1) Location? Right abutment			
(2) Type of Spillway? Uncontrolled chute			
(3) Size of Spillway? 125 foot crest width			
(4) Spillway lining? Reinforced concrete			
(5) Is there a weir?	X		
(6) Is the spillway in good condition?		X	See comments.
(7) Any drains?	X		
a. Describe the condition of drains. See comments.			

#### B. Does spillway show:

(1) Any cracking concrete?	X		See comments, Section 4.(A).6.
(2) Any spalling concrete?	X		See comments, Section 4.(A).6.
(3) Any exposed reinforcement in the concrete?		X	
(4) Any erosion?		X	

ITEM	YES	NO	REMARKS
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**4. SPILLWAY** (continued)

B. Does spillway show: (continued)

(5) Any slope sloughing?		X	
(6) Any obstructions?		X	
(7) Displacement or offset joints?	X		See comments, Section 4.(A).6.
(8) Loss of joint material?	X		See comments, Section 4.(A).6.
(9) Leakage at the joints?	X		See comments.
(10) Other?		X	

C. Do the energy dissipaters show:

(1) Signs of deterioration?			
(2) Any cracking?			
(3) Any spalling?			
(4) Any exposed reinforcement?			
(5) Are they covered with debris?			
(6) Other?			

D. Has release water:

(1) Eroded the embankment?		X	
(2) Undercut the outlet?		X	
(3) Eroded the downstream channel?		X	
(4) Other?		X	

E. Emergency Spillway

(1) Is there an emergency spillway?		X	(If YES, describe)

ITEM	YES	NO	REMARKS
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## 5. RESERVOIR CONTROL

A) Recent upstream development?		X	
B) Recent downstream development?		X	
C) Slides in reservoir area?		X	
D) Change in reservoir operation?		X	
E) Large impoundment upstream?		X	
F) Any debris in the reservoir?		X	
G) Other?		X	

## 6. INSTRUMENTATION

A) List type(s) of instrumentation: See comments.			
B) In good condition?	X		Installed new in fall of 1999
C) Read periodically?	X		Monthly except in winter months
D) Is data available?	X		
E) Include all data gathered since last report. See Figures 1,2, 3, and 4.			

## 7. DOWNSTREAM CONDITION

### A. Downstream Land Use.

Farm and ranch land, town of Alder.
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This dam was inspected by: Dirk Roberts, P.E., Neil Todd

Inspection Report by: Randy Laskowski

Report Reviewed by: Robert Kingery, P.E.



## **Comments**

**General.** A feasibility study for a major rehabilitation of this structure was completed in 2008. Proposed work includes replacement of the spillway, increasing the storage capacity of the reservoir and modifications to the outlet works.

**Section 1.B.(1).** There is some minor wave scarping near the left upstream groin. It appears as though the eroding material is wind blown sand that is covering the original 30-inch thick layer of riprap. (Comment from 2007 report).

**Section 1.B.(8).** There is a minor accumulation of branches and small logs on the upstream face which need to be removed (Photos 1, 2).

**Section 1.B.(9).** There is some sagebrush on the upstream face that needs to be sprayed/removed (Photos 1, 2).

**Section 1.C.(5).** The existing embankment drain consists of a toe drain, a drain that drains two springs located under the embankment (encountered during construction) and a drain along the upstream portion of the conduit. The embankment drain is believed to exit in the spillway channel 200 to 300-feet downstream toward the end of the spillway.

**Section 1.D.** There are bushes and small trees scattered on the downstream face of the embankment (Photos 3, 4). The sage brush is especially thick on the lower portion of the downstream face and at the toe. The bushes, trees, and sage brush need to be removed.

**Section 3.B.(2).c.** There are approximately fifteen cracks/joints in the downstream portion of the conduit that appear as though they have leaked a small amount at some point. There is no evidence of sediment transport. (Comment from 2007 Inspection).

During the 2008 Inspection, one old crack was observed which had built up calcium deposits (Photo 5). No changes were noted from previous inspections.

**Section 3.B.(6).** There is a 6-inch drain that exits from the left side of the outlet conduit a short distance downstream from the gates. It drains a spring (encountered during original construction) and runs approximately 100-feet along the upstream portion of the conduit before exiting into the conduit. The flow was estimated to be about 73 gpm on July 9, 1998 with the use of a current meter. It was flowing during the 2008 inspection (no estimated rate).

**Section 3.C.(4).** The packing around the emergency gate leaks approximately 10 gpm when the gate is closed. It has been leaking for many years. One of the bolts was missing and was recently replaced. The threads and bolt are heavily corroded preventing the bolt from being turned in very far (from 2007 report).

### **Comments (continued)**

**Section 3.C.(5).** During the 2007 inspection the emergency gate was closed and sealed well. The operating gate was exercised to the open position. There was no leakage around the emergency gate during the 2008 inspection.

**Section 3.C.(7).** There is cavitation damage on both sides of the operating gate stem deflector, around the jet pump outlet, and on the crown of the conduit. Previous reports indicate that the damaged areas are typically repaired on an annual basis (from 2007 inspection).

Cavitation repairs were performed in July 2008 by SWPB personnel. During the 2008 inspection the conduit was in good condition. Cavitation repairs were in good shape (Photos 6, 7, and 8). There were several minor chips areas on front of the gate stem deflector where excess material had been smeared out.

**Section 3.C.(9).b.** In November, 2005 there was approximately 20-feet of water in the bottom of the tower. Water had filled the tower to the elevation of the air vent. Apparently vibrations caused the 1<sup>st</sup> pump control valve to close on its own. Therefore the jet pump did not work. The tower filled with water to the elevation of the air vent. There are currently three control valves on the upstream leg of the jet pump line. The furthestmost valve downstream reportedly shuts off most of the flow and the other two are inoperable.

**Section 3.C.17** An attachment from the gatehouse wall to the ball valve handle for the downstream valve that prevents backflow into the tower needs to be made. The attachment should be able to hold the ball valve handle approximately 9 inches away from the wall and stabilize the handle (Photo 9). The threaded stem connection also needs to be locked so that it does not unscrew when attempting to open the valve.

**Section 3.D.(1).b.** The concrete outlet structure is severely cracked and severely spalled in several places (Photo 10). The damage does not appear to be fresh or rapidly worsening (comment from 2007 report).

**Section 3.E.(3).** There is a measuring weir across the outlet channel that includes a square concrete wet well (Photo 11). The wet well has a square (approximately 2' x 2') opening at the top and is very deep. The opening is not marked and is potentially very dangerous. The wet well should be covered and secured. (2007 Report).

**Section 4.A.(6).** The spillway is in very poor condition. The spillway floor was repaired in 1965, 1994, 1998, 2007, and again in 2008. When the reservoir started spilling in 2008, spalling occurred on the lower left hand floor of the spillway creating a large wave of water (Photo 12). After spilling stopped, the spillway showed extensive damage along one of the joints (Photo 13). Numerous areas on the spillway floor were repaired with concrete (deep repairs) and SIKATOP 123 PLUS (shallow repairs) during September 2008 (Photos 14, 15, 16 and 17).

### **Comments (continued)**

Both spillway walls are also in very poor condition. Pattern cracking (D-cracks) and significant spalling (Photo 18) are typical along the tops of both walls.

**Section 4.A.(7).a.** There are two spillway drains that exit the spillway floor near the bottom of the spillway. The lower drain exits just above the flip bucket and is normally flowing. The upper drain flows when the reservoir is approximately at elevation 5390. There are also two 8-inch drains that exit in the bottom of the flip bucket. A small sediment deposit has been observed at the spillway floor drains near the upstream edge of the flip bucket in both 2007 and 2008.

**Section 4.B.(9).** The transverse joint just above the flipbucket has water exiting from it when the reservoir reaches an elevation of approximately 5390. Weep holes were drilled through the floor slab just below the joint in 1996 in order to drain the floor foundation.

**Section 6.(A).** In the fall of 1999, 13 piezometers were installed in 7 drill holes. They are located in the spillway approach channel, through the dam crest, and at the toe of the dam (see Figure 1.) The most recent piezometers and reservoir elevation data is shown in Figure 2, 3 and 4.

### **Maintenance Recommendations**

1. Cover the concrete wet well located on the left side of the old measuring weir. (July 2009).
2. Make an attachment from the ball valve handle in the gatehouse to the wall to stabilized the handle during operation.

### **Annual Maintenance Recommendations**

2. Spray/kill and remove the trees and the large brush on the downstream face of the dam, the upstream face of the dam, and around the outlet works. Focus the efforts around and above the outlet portal and along the embankment toe (June 2009).

## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 1 – Crest and upstream embankment (looking east).



Photo 2 – Upstream embankment (looking west).



## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 3 – Downstream embankment (spillway in background).



Photo 4 – Downstream embankment and spillway.



## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 5 – Crack in conduit with calcium deposits.



Photo 6 – Cavitation repairs.

Ruby Dam 2008 Annual Inspection Photographic Log



Photo 7 – Cavitation repairs.



Photo 8 – Cavitation repairs.



## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 9 – Handle that needs stabilizing attachment to wall.



Photo 10 – Outlet works with cracks and chips.



## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 11 – Wet well that needs to be covered.



Photo 12 – Spillway with wave (rooster tail) from damaged area.



## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 13 – Spillway damage after 2008 spilling.



Photo 14 – Breaking out damaged concrete in spillway.



## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 15 – Breaking out damaged concrete in spillway.



Photo 16 – Spillway repair.



## Ruby Dam 2008 Annual Inspection Photographic Log



Photo 17 – Spillway repairs.



Photo 18 – Damaged spillway wall.

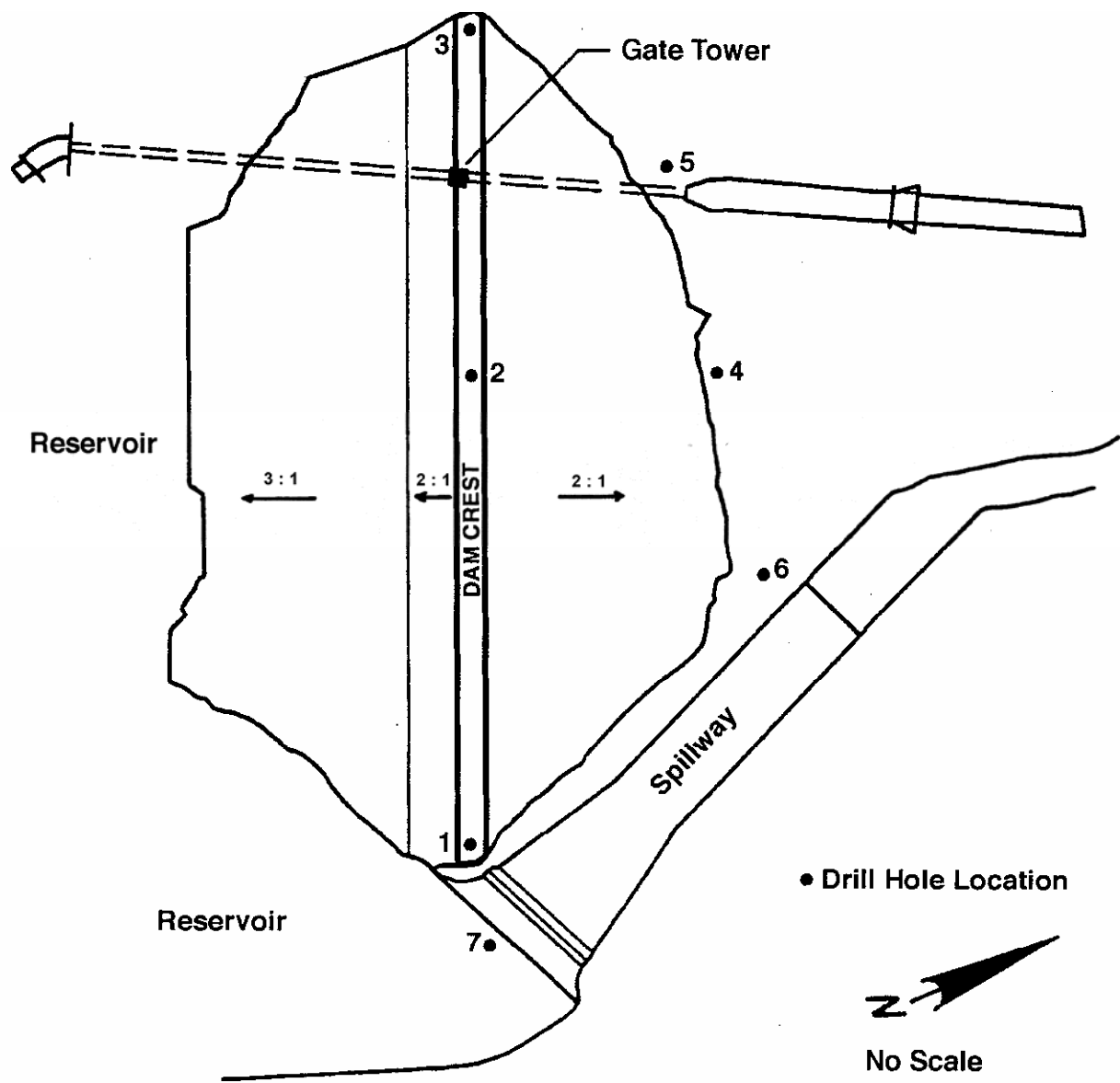
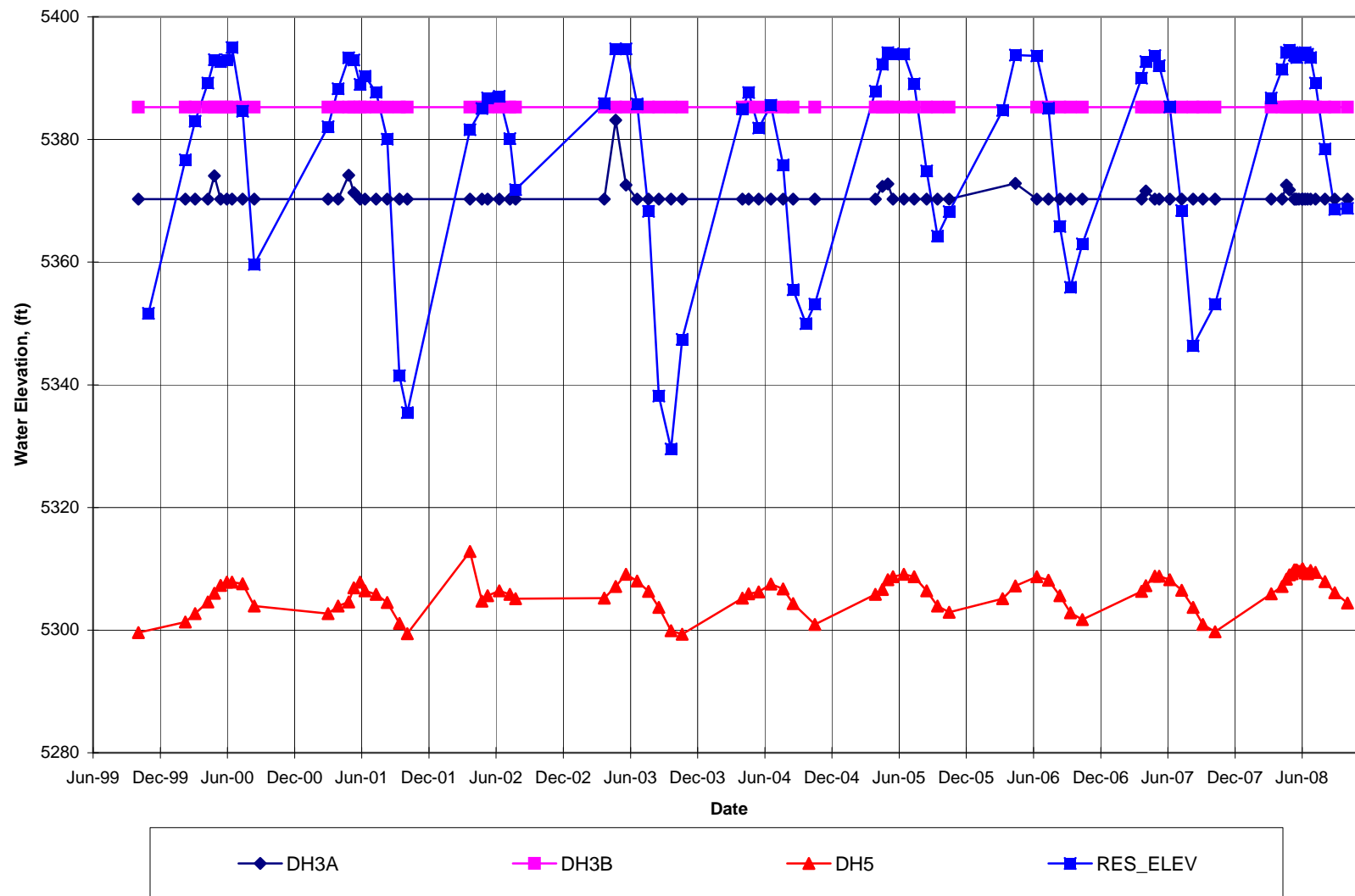
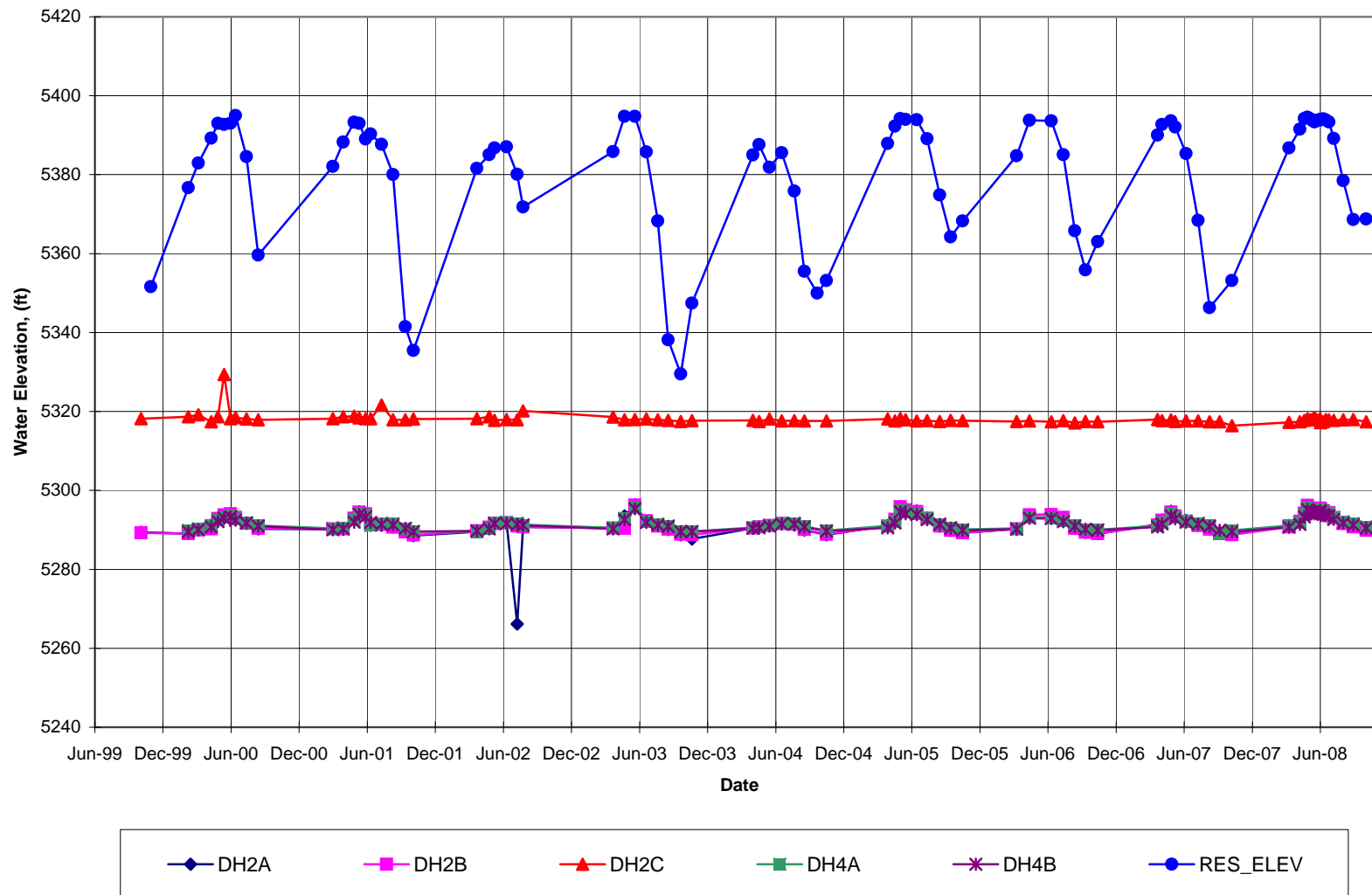


Figure 1 – General Site Layout, Ruby River Dam

FIGURE 2 - RUBY RESERVOIR - Left of Outlet



**FIGURE 3 - RUBY RESERVOIR - Right of Outlet**



**FIGURE 4 - RUBY RESERVOIR - Right Abutment/Spillway**

